(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
5 July 2001 (05.07.2001)

PCT

(10) International Publication Number
WO 01/48654 A1

(51) International Patent Classification[7]: G06F 17/60, 3/033, G06K 11/18

(21) International Application Number: PCT/SE00/02660

(22) International Filing Date:
22 December 2000 (22.12.2000)

(25) Filing Language: Swedish

(26) Publication Language: English

(30) Priority Data:
9904746-6 23 December 1999 (23.12.1999) SE

(71) Applicant *(for all designated States except US)*: **ANOTO AB** [SE/SE]; c/o C Technologies AB, Scheelevägen 15, S-223 70 Lund (SE).

(72) Inventors; and

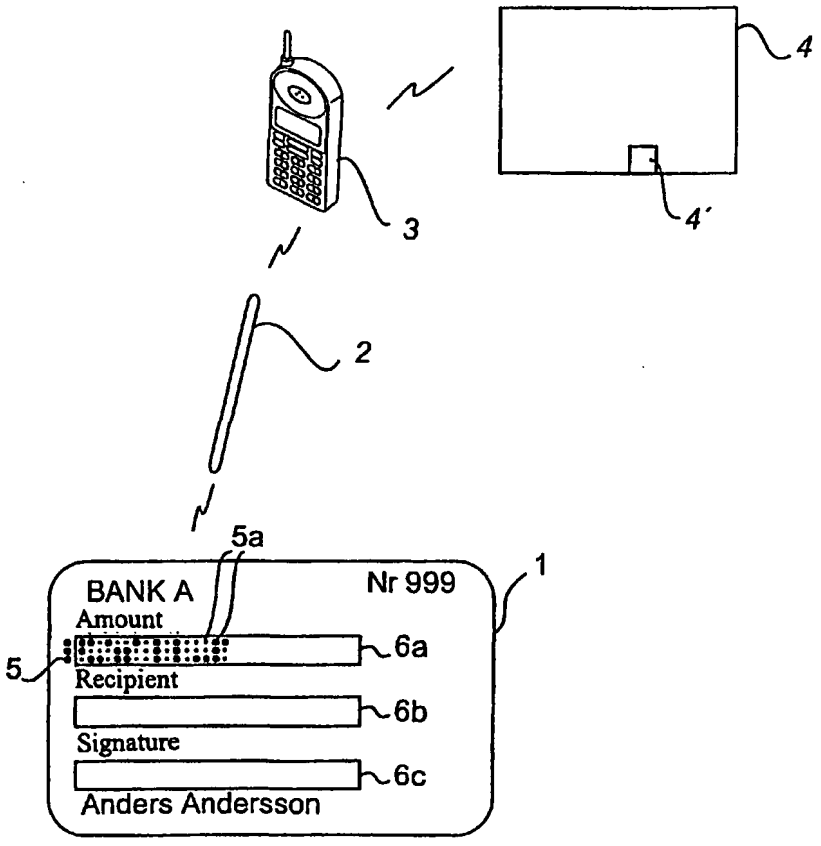
(75) Inventors/Applicants *(for US only)*: **ERICSON, Petter** [SE/SE]; Industrigatan 2 B, S-212 14 Malmö (SE). **FÅHRAEUS, Christer** [SE/SE]; Sölvegatan 3 A, S-223 62 Lund (SE). **WIEBE, Linus** [SE/SE]; Bokhållaregatan 33, S-211 56 Malmö (SE). **SKANTZE, Kristofer** [SE/SE]; Jutahusgatan 6, S-222 29 Lund (SE).

(74) Agent: **AWAPATENT AB**; Box 5117, S-200 71 Malmö (SE).

(81) Designated States *(national)*: AE, AG, AL, AM, AT, AT (utility model), AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, CZ (utility model), DE, DE (utility model), DK, DK (utility model), DM, DZ, EE, EE (utility model), ES, FI, FI (utility model), GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK

[Continued on next page]

(54) Title: INFORMATION MANAGEMENT SYSTEM WITH AUTHENTICITY CHECK



(57) Abstract: A payment product has a writing area (6c) which is intented for a user's signature. In the writting area there is a first position-coding pattern (5) which makes possible digital recording of the signature. The first position-coding pattern is a subset of a larger second position-coding pattern. The payment product is used in a payment system which is based on electronic payment information, which has been recorded by means of the position-coding pattern, being sent to a server unit, which utilises the position-coding pattern to check that the payment information is valid.

WO 01/48654 A1

INFORMATION MANAGEMENT SYSTEM WITH AUTHENTICITY CHECK

Field of the Invention

This invention relates to a payment product comprising at least one writing area which is intended to receive handwritten information from a user and which is provided with a first position-coding pattern which makes possible digital recording of the handwritten information. The invention also relates to a server unit, a system for information management, use of an absolute position-coding pattern and a hand-held electronic user unit.

Background Art

Security in association with payment by means of cheques is a problem. There is always a risk that an unauthorised person will obtain another person's cheques, forge this person's signature and in this way obtain money that belongs to the owner of the cheque or buy goods that are charged to the owner of the cheque.

Many solutions have been proposed which aim to make it more difficult for unauthorised persons to forge signatures and use another person's cheques.

EP 0 276 109 describes a cheque which, in a writing area where the user is to write his signature, is provided with a shading which varies in intensity from the upper edge to the lower. The user signs the cheque with a pen which has a sensor which records the intensity at the pen point. The pen thus produces an output signal which has an intensity which varies with time, depending upon the position of the pen on the writing area.

As an alternative, the writing area can be provided with a large number of squares all of which have shading with different intensity. Also in this case, the pen produces an output signal which varies in intensity with time, depending upon the position of the pen on the writing area.

Summary of the Invention

It is thus a general object of this invention to show a solution to the above problems.

It is also a special object to show a solution which makes possible increased security in association with payment orders which require the payer's signature on a payment product.

These objects are achieved completely or partially by means of a payment product according to claim 1, a server unit according to claim 12, a system for information management according to claim 19, use according to claim 30 and a user unit according to claim 32.

More specifically, according to a first aspect, the invention relates to a product comprising at least one writing area which is intended to receive handwritten information from a user and which is provided with a first position-coding pattern which makes possible digital recording of the handwritten information. The product is characterised in that the first position-coding pattern is a subset of a second position-coding pattern, which is an absolute position-coding pattern which codes coordinates of a plurality of points on an imaginary surface, the first position-coding pattern being intended both for the digital recording of the handwritten information and for authenticity checking.

An advantage of using a position-coding pattern which is a subset of a larger absolute position-coding pattern is thus that security can be increased by utilising checks which are based on the knowledge that a particular product is provided with a specific subset of the larger position-coding pattern.

The first position-coding pattern on the product has thus a dual function. It makes possible digital recording of a position locally on the writing area on the product so that handwritten information can be recorded, and also makes possible the determination of a position globally

ed to check that the digital version actually originates from a particular physical product.

The resolution of the first position-coding pattern is suitably such that digital reproduction of the handwritten information is made possible. It is thus possible to show digitally an image of how the handwritten information appears on the physical product. In addition, with knowledge of the appearance of the physical product, it is possible to create a precise digital copy of the physical product with the handwritten information.

There are known absolute position-coding patterns, see for example US 5,852,434, where each position is coded by means of a unique symbol. This has the disadvantage that each symbol becomes rather complex, at least if a large number of positions are to be coded, which in turn means that the symbols cannot be made too small, as they would then be difficult to read and the risk of errors would increase. In addition, in each position the device which is to read the position-coding pattern must read an area corresponding to four symbols in order to be certain of recording a complete symbol.

According to the invention, the first position-coding pattern is instead constructed of a plurality of symbols, the coordinates of each point being coded by means of a plurality of symbols and each symbol contributing to the coding of more than one point. In this way, a high resolution is achieved. Examples of this type of position code are to be found in Applicant's International Patent Applications WO 00/73983 and PCT/SE00/01895. These applications are incorporated herewith by reference.

In an advantageous embodiment, the first position-coding pattern is unique to the authorised user of the product. Each user can thus be allocated his "own" subset of the larger position-coding pattern. This subset can, for example, be arranged on cheques or on some other product which belongs to the user and which is used to

tion was written on a particular category of product, for example cheques as distinct from postal giro forms.

In a preferred embodiment, the handwritten information comprises the user's signature. Many products, particularly payment products, require a signature from a user as confirmation of the transaction that the product defines. In such cases the signature can be recorded, checked and stored digitally by means of the first position-coding pattern. It is thus possible to carry out transactions digitally which previously could only have been carried out with paper products. For example, it is possible to process cheques digitally for payment remotely via computer networks. To date a user has been forced to hand over a signed paper cheque, when he or she has wanted to pay by cheque. With a product according to this invention it is, however, possible to identify the product by reading the unique position-coding pattern on which the signature is written and it is thus possible to carry out electronic transactions. In addition, this has the advantage that the user retains a paper copy of the payments he or she has made.

In order for a signature on a cheque to be accepted, it is thus not sufficient for it to resemble a previously stored signature, but it must also be written on the "correct" subset of the position-coding pattern.

In one embodiment, the product can comprise a plurality of additional writing areas for recording additional handwritten information which is related to the product, which additional writing areas are provided with position-coding patterns which make possible digital recording of the additional handwritten information.

The first position-coding pattern can thus be repeated in the additional writing areas. Alternatively, the first position-coding pattern can constitute a greater part of the second larger position-coding pattern, so that the first position-coding pattern can cover all the writing areas and so that the positions within

that the server unit has access to a memory, in which is stored information about a plurality of regions, each of which represents a coordinate area on at least one imaginary surface, that the server unit is arranged to receive said information in the form of at least two coordinates for at least one point on the imaginary surface, and that the server unit is arranged to determine to which region the coordinates belong in response to the receipt of the information from one of the said user units, and to carry out an authenticity check on the received information on the basis of the region affiliation.

According to the invention, at least one imaginary surface is thus used, which is divided into different regions (coordinate areas) in order to make possible authenticity checking. The handwritten information is channelled via the server unit which identifies to which region the coordinates belong. Different regions can, for example, be associated with different products, with different companies and/or with different users of a product. In this way, it is possible to build one or more security levels into a system for information management.

The system provides many advantages for different users. An individual who uses the system can identify himself in a secure way without the use of passwords, PIN numbers, smart cards or other security systems. As the information is recorded electronically, the user can retain the physical product as a reminder and/or as proof of the information which was recorded digitally and sent to a server unit.

A company which uses the system can lease a region or gain access to a region in some other way. The company can then check, or have the server unit check, that the handwritten information which is received in digital form is represented by coordinates from the correct region.

The coordinates which the user units record can be sent to the server unit in some form which requires pro-

The user identity can be a serial number of the user unit or some form of code which has been stored in the user unit specifically for this purpose.

In a preferred embodiment, a signature of the authorised user of the region is associated with at least certain of the regions, said information comprising a digital representation of a user's signature and the server unit being arranged to compare the signature in the received information with the signature associated with the region concerned when carrying out an authenticity check.

The signature is represented in the form of coordinates which are received from the user unit. The coordinates have thus the dual function of both representing the signature and indicating the region affiliation. It is possible to determine which coordinates represent the signature in the received information due to information being stored in the server unit about which coordinate area corresponds to the position-coding pattern on the writing area where the signature is to be written on the product.

By combining checking that the coordinates belong to the correct region, that the information is written using the correct user unit and that the signature is correct, a very high level of security can be achieved.

It should also be pointed out that the signature check can alternatively be carried out by signature verification software in the user unit. Only after the user unit has approved the signature, is the rest of the handwritten information forwarded to the server unit, where a further authenticity check can be carried out on the basis of which region the received coordinates belong to and on the basis of the unique user identity of the user unit.

The server unit can be the unit which finally processes the received information. However, the server unit is preferably just an intermediate unit which carries out

server unit is arranged to determine, in response to the receipt of the information from one of said user units, to which region the coordinates belong and to carry out an authenticity check on the received information on the basis of the region affiliation.

According to a fourth aspect of the invention, this relates to use of an absolute position-coding pattern on a product in order to make it possible to check that a user is entitled to use the product, the absolute position-coding pattern being unique to the authorised user.

According to a fifth aspect of the invention, this relates to a hand-held electronic user unit, which is intended to be used in the system described above.

In a advantageous embodiment, the account number of the holder is stored in the user unit, so that it can be sent to a server unit automatically, without the user having to record all the digits in the number each time.

A hand-held electronic user unit with at least one stored account number could be used in other systems than the one described above.

The advantages of the system and the use are apparent from the discussion above.

It is realised that the characteristics which are discussed above for the product and the server unit, can also be applicable to the system, the use and the user unit.

Brief Description of the Drawings

This invention will now be described in greater detail by way of example and with reference to the accompanying drawings.

Fig. 1 is a schematic view of a system according to an embodiment of this invention.

Fig. 2 is a schematic internal view of a user unit.

Fig. 3 is a schematic diagram of a storage structure for region-based rules for information processing.

is required in connection with digital processing of cheques. One example could be a writing area in which the user specifies to which bank account the payment is to be made.

The Position-Coding Pattern

The position-coding pattern 5 can be constructed in various ways, but has the general characteristic that if any part of the pattern of a particular minimum size is recorded, then the position of this in the position-coding pattern and thus on the payment product can be determined unambiguously.

The position-coding pattern 5 can be of the type which is shown in the above-mentioned US 5,852,434, where each position is coded by a specific symbol.

It is, however, desirable for the position-coding pattern to be used to record information at a high resolution and in addition to be used in a system which permits varied processing of the information. Therefore the pattern should be designed in such a way that it can code a very large number of positions given by absolute coordinates at high resolution. In addition, the position-coding pattern should be coded graphically in such a way that it does not dominate or interfere with the visual impression of the surface of the product. It should also be possible to detect the position-coding pattern with high reliability.

Therefore the position-coding pattern is advantageously of the type which is shown in the published international patent application WO 00/73983 filed on 26 May 2000, or in the international patent application PCT/SE00/01895 filed on 2 October 2000, both of which applications are assigned to the present Applicant. In these patterns each position is coded by a plurality of marks or symbols, and each symbol contributes to the coding of several positions. The position-coding pattern is constructed of a small number of types of symbols.

A surface which is provided with the above-mentioned pattern printed with a carbon-based black printing ink will be perceived by the eye as only a pale grey shading of the surface (1-3% density), which is user-friendly and aesthetically pleasing.

Of course, fewer or more symbols can be used to define a position than as described above, and larger or smaller distances between the symbols can be used in the pattern. The examples are only given to show a currently preferred realisation of the pattern.

The User Unit

Fig. 2 shows an example of a user unit 2, which in this case consists of a digital pen. It comprises a casing 11 which is approximately the same shape as a pen. In a short side of the casing there is an opening 12. The short side is intended to be held in contact with or a short distance from a base provided with a position-coding pattern.

The casing essentially contains an optics part, an electronic circuitry part and a power supply.

The optics part forms a digital camera and comprises at least one infrared light-emitting diode 13 for illuminating the surface which is to be imaged and a light-sensitive area sensor 14, for example a CCD or CMOS sensor, for recording a two-dimensional image. The user unit may also contain a lens system. The infrared light is absorbed by the symbols in the position-coding pattern and in this way makes them visible to the sensor 14. The sensor records advantageously at least 100 images per second.

The power supply for the pen is obtained from a battery 15 which is mounted in a separate compartment in the casing. Alternatively, however, the pen can be connected to an external power source.

The electronic circuitry part comprises a signal processor 16 for determining a position on the basis of the image recorded by the sensor 14 and more specifically a processor unit with a microprocessor which is program-

extending and retracting the pen point, in the same way as in an ordinary ball-point pen, can also function as an on/off button for the pen, so that the pen is activated when the pen point is extended. The pen also comprises buttons 18 by means of which the pen can be activated and controlled.

The pen 2 is arranged to transmit payment information which is generated by the user to the server unit 4. In the example according to Fig. 1, the information is transmitted wirelessly to the network connection unit 3, which in turn transmits the information to the server unit 4.

In this example, the network connection unit is a mobile telephone 3. It can alternatively be a computer or some other suitable unit which has an interface to a network, for example the Internet, a local company network, or a telephone network. The network connection unit 3 can alternatively constitute an integrated part of the pen 2.

All the recorded data can be stored in a buffer memory 20 awaiting transmission to the central unit 4. Thus the digital pen 2 can work in stand-alone mode, that is the pen 2 sends the information when it has the opportunity, for example when it makes contact with the network connection unit 3, whereupon it retrieves recorded information from the buffer memory 20.

The communication between the pen 2 and the network connection unit 3, which are normally located fairly close to each other, can be carried out via infrared or radio waves, for example in accordance with the Bluetooth® technology, or some other technology for the transfer of information across short distances. For this purpose the pen 2 has a transceiver 19 for wireless communication with external units, preferably a Bluetooth® transceiver.

Alternatively, the transmission can be via cables. For example, the user unit 2 can be connected via a cable

to be able to carry out the functions described here. It also has information stored in its memory 4' in order to be able to handle these functions. The server unit 4 can alternatively be some other type of network-connected computer or a local computer, with which the user unit 2 communicates wirelessly or by cables.

As shown above, several user units 2 can be arranged to send their information to the server unit 4 which is thus a central part of the system. Several such systems can, however, together form an even larger system.

The server unit 4 does not need to be incorporated in a global network, but can be incorporated in a local network and can be used to manage information, for example within a company.

The server unit's 4 memory 4' comprises a database with information about the total surface of positions which the position-coding pattern can code. The total surface forms an imaginary surface which can be said to be a surface in a coordinate system, which surface thus contains a large number of positions which are systematically arranged in two dimensions with a particular specified resolution. This can also be expressed by saying that the total surface is made up of all the points or positions which the position-coding pattern has the capacity to code. Each position can be defined by two associated coordinates which form a pair of coordinates. If there is more than one imaginary surface, more than two coordinates can be required in order to define a position.

The imaginary surface is divided into a number of areas which are called regions. The regions can be different sizes and be different shapes. The whole surface does not need to be occupied by regions. In the server unit's memory there is information stored concerning the position and extent of these different regions. A rectangular region can, for example, be described by means of

The Function of the System

In this embodiment the function of the system is as follows. A user writes, using the pen point 17 of the user unit 2, an amount, a payment recipient and his signature on the cheque 1. The payment information is recorded electronically at the same time as it is being written with the pen point on the cheque, by the user unit 2 continually recording the part of the position-coding pattern which is within the field of view of the area sensor 14 during the writing. The signal processor 16 converts the position-coding pattern into absolute coordinates. The signal processor thus generates a sequence of pairs of coordinates which describes how the user has moved the user unit over the cheque during the writing. The signal processor compresses the payment information by converting it into a polygon train of pairs of coordinates. Then the signal processor generates a message which contains the polygon train and the unique user identity which is stored in the user unit. The message is transmitted to the network connection unit 3 which in turn transmits the message to the server unit 4.

When the server unit 4 receives the message, it determines to which region one or more of the pairs of coordinates in the polygon train belong. Then it uses the information associated with the region to carry out the authenticity check.

In order to increase the capacity of the system to manage information, this can comprise several server units 4, each of which contains information about at least part of the imaginary surface. In this case, however, each user unit 2 must know, or be able to obtain information about, to which of the server units the recorded information is to be sent. For this purpose the user unit's 2 memory can contain information about the association between server units and regions on the imaginary surface. The user unit 2 is thus arranged to determine, after recording of the information, the region

35 in order to check that they are also the same. In addition, the server unit interprets the other payment information in the message and converts it into character-coded format. The character-coded payment information, the name of the user and the result of the comparison are sent to the recipient, which is the bank which issued the cheque. If the user is the authorised user, the bank makes the payment.

Alternatively, the server unit can be the bank's own server unit which carries out the authenticity check itself.

In the example above, the position-coding pattern on the cheque is unique to the user. It can also be unique to each individual cheque, so that the cheque number can be determined from the position-coding pattern. The server unit can then also check that the cheque has not already been used and that it has a number which follows the most recently used cheque. In order to increase the security further, the position-coding pattern for the consecutive cheques can be randomly distributed within a region or can belong to regions which are not consecutive.

Application Example 2

A user has been allocated a personal region by a credit card company, together with a pad of credit card receipts which are provided with the position-coding pattern from this region. The position-coding pattern can be the same on all the receipts or different on the different receipts if the level of security is to be higher.

Assume that the user finds a product on the Internet that he wants to buy. He can then pay by using one of his credit card receipts and his personal user unit. He writes the amount which is to be paid, the payment recipient, a reference and any additional information which is required in order for the payment to be identified on the credit card receipt and finally signs it.

server unit 4 in Fig. 1, sends the agreement in digital form in a file to a computer which belongs to a person who is to sign the agreement. The file with the agreement includes a position-coding pattern which has been specifically allocated to that agreement and the person who is to sign the agreement. When the person receives the agreement file, he prints out the agreement and signs it in the designated place on the position-coding pattern using his personal user unit. This sends the signature to the server unit 4, which can determine, by means of the coordinates by which the signature is represented, that the signature is written on the agreement which was sent to the party to the agreement. If required, the authenticity of the signature can also be verified in a database which stores unique user identities and associated signatures. As an alternative, the user unit itself checks the authenticity of the signature and only forwards it if it is in order.

In the description above, it has been assumed that the payment product is provided with a position-coding pattern from the start. However, a payment product which is not already provided with a position-coding pattern can have such a pattern applied later, by means of a printer, copier or the like. For this, the payment product is placed in the printer's input paper bin. The printer is programmed to print out the first position-coding pattern which is reserved for a particular person, by entering a personal identity code. The personal identity code means that the printer can print out the correct pattern, which is allocated to the person who is authorised to use the product. In the case of a copier, the product is placed in the input bin and an original with the user's personal pattern is placed as the document which is to be copied. It is also possible to have the personal pattern on a sheet of plastic, which is placed over the payment document and the information is filled in on the plastic sheet. The plastic sheet is then

ment which is sent to the bank. The bank can verify the signature again, possibly using even better software than that used in the pen, in order to further improve the security. Other combinations of measures can be used, for example the signature can be used to initiate locking of the file, while transmission is initiated in another way, for example by activating a switch on the pen or by marking a separate "send" box.

The transmission to the bank can be combined with a transmission to the person's own personal computer in order to achieve a logging of the payments which have been ordered. In addition, the bank can confirm the receipt of a payment order, and confirm that the payment order could be interpreted and implemented. Such confirmation can be sent to a mobile phone which the user uses and/or to the user in person or to the user's personal site on an Internet-based server.

In another scenario, it is possible for the owner of the pen to receive a confirmation of the recipient to whom the document is to be forwarded, for example by an indication on said mobile phone. The user has the opportunity to approve the forwarding to the recipient by using for example the telephone's keypad. In such a way, the recipient can be authorised.

APPENDIX

In the following the description is reproduced of a preferred position-coding pattern according to the International Patent Application PCT/SE00/01895.

Fig. 4 shows a part of a product in the form of a sheet of paper A1, which on at least part of its surface A2 is provided with an optically readable position-coding pattern A3 which makes possible position determination.

The position-coding pattern comprises marks A4, which are systematically arranged across the surface A2, so that it has a "patterned" appearance. The sheet of paper has an X-coordinate axis and a Y-coordinate axis. The position determination can be carried out on the

nominal position A6, which can also be called a raster point, is represented by the intersection of the raster lines A8. The mark A7 has the shape of a circular dot. A mark A7 and a raster point A6 can together be said to constitute a symbol. In one embodiment, the distance between the raster lines is 300 μm and the angle between the raster lines is 90 degrees. Other raster intervals are possible, for example 254 μm to suit printers and scanners which often have a resolution which is a multiple of 100 dpi, which corresponds to a distance between points of 25.4 mm/100, that is 254 μm.

The value of the mark thus depends upon where the mark is located relative to the nominal position. In the example in Fig. 5 there are four possible locations, one on each of the raster lines extending from the nominal position. The displacement from the nominal position is the same size for all values.

Each mark A7 is displaced relative to its nominal position A6, that is no mark is positioned at the nominal position. In addition, there is only one mark per nominal position and this mark is displaced relative to its nominal position. This applies to the marks which make up the pattern. There can be other marks on the surface which are not part of the pattern and thus do not contribute to the coding. Such marks can be specks of dust, unintentional points or marks and intentional marks, from for example a picture or figure on the surface. Because the position of the pattern marks on the surface is so well-defined, the pattern is unaffected by such interference.

In one embodiment, the marks are displaced by 50μm relative to the nominal positions A6 along the raster lines A8. The displacement is preferably 1/6 of the raster interval, as it is then relatively easy to determine to which nominal position a particular mark belongs. The displacement should be at least approximately 1/8 of the raster interval, otherwise it becomes difficult to determine a displacement, that is the requirement for

Mark value	x-code	y-code
1	1	1
2	0	1
3	1	0
4	0	0

The value of each mark is thus converted into a first value, here bit, for the x-code and a second value, here bit, for the y-code. In this way two completely independent bit patterns are obtained by means of the pattern. Conversely, two or more bit patterns can be combined into a common pattern which is coded graphically by means of a plurality of marks in accordance with Fig. 5.

Each position is coded by means of a plurality of marks. In this example, 4*4 marks are used to code a position in two dimensions, that is an x-coordinate and a y-coordinate.

The position code is constructed by means of a number series of ones and zeros, a bit series, which has the characteristic that no four-bit-long bit sequence occurs more than once in the bit series. The bit series is cyclic, which means that the characteristic also applies when the end of the series is connected to its beginning. A four-bit sequence has thus always an unambiguously determined position number in the bit series. The bit series can be a maximum of 16 bits long if it is to have the characteristic described above for bit sequences of four bits. In this example, however, only a seven-bit-long bit series is used, as follows:

"0 0 0 1 0 1 0".

This bit series contains seven unique bit sequences of four bits which code a position number in the series as follows:

The pattern is divided into code windows F with the characteristic that each code window consists of 4*4 marks. There are thus four horizontal bit sequences and four vertical bit sequences available, so that three differences can be created in the x-direction and four position numbers can be obtained in the y-direction. These three differences and four position numbers code the position of the partial surface in the x-direction and the y-direction. Adjacent windows in the x-direction have a common column, see Fig. 4. Thus the first code window $F_{0,0}$ contains bit sequences from the columns K_0, K_1, K_2, K_3, and bit sequences from the rows R_0, R_1, R_2, R_3. As differences are used in the x-direction, the next window diagonally in the x-direction and y-direction, the window $F_{1,1}$, contains bit sequences from the columns K_3, K_4, K_5, K_6, and the rows R_4, R_5, R_6, R_7. Considering the coding in just the x-direction, the code window can be considered to have an unlimited extent in the y-direction. Correspondingly, considering the coding in just the y-direction, the code window can be considered to have an unlimited extent in the x-direction. Such a first and second code window with unlimited extent in the y-direction and x-direction respectively together form a code window of the type shown in Fig. 4, for example $F_{0,0}$.

Each window has window coordinates F_x, which give the position of the window in the x-direction, and F_y, which give the position of the window in the y-direction. Thus the correspondence between the windows and columns is as follows:

$$K_i = 3\ F_x$$
$$R_i = 4\ F_y$$

The coding is carried out in such a way that for the three differences, one of the differences Δ_0 always has the value 1 or 2, which indicates the least significant digit S_0 for the number which represents the position of the code window in the x-direction, and the other two

x-coordinates by means of code windows. The cyclic number series, that is the same number series as is used for the x-coding, is written repeatedly in horizontal rows across the surface which is to be position coded. Precisely as for the x-coordinates, the rows are made to start in different positions, that is with different bit sequences, in the number series. For the y-coordinates, however, differences are not used, but the coordinates are coded by values which are based on the start position of the number series in each row. When the x-coordinate has been determined for a partial surface with 4*4 marks, the start positions in the number series can in fact be determined for the rows which are included in the y-code for the 4*4 marks.

In the y-code, the least significant digit S_0 is determined by letting this be the only digit which has a value in a particular range. In this example, one row of four starts in position 0 to 1 in the number series, in order to indicate that this row concerns the least significant digit S_0 in a code window, and the three other rows start in any of the positions 2 to 6 in order to indicate the other digits S_1 S_2 S_3 in the code window. In the y-direction there is thus a series of values as follows:

(2 to 6); (2 to 6); (2 to 6); (0 to 1); (2 to 6); (2 to 6); (2 to 6); (0 to 1); (2 to 6); ...

Each code window is thus coded by three values between 2 and 6 and a subsequent value between 0 and 1.

If zero (0) is subtracted from the low value and two (2) from the other values, a position in the y-direction S_3 S_2 S_1 S_0 in mixed base is obtained in a corresponding way as for the x-direction, from which the position number of the code window can be determined directly, which is:

$S_3 * (5*5*2) + S_2 * (5*2) + S_1 * 2 + S_0 * 1$

Using the method above, it is possible to code 4 * 4 * 2 = 32 position numbers in the x-direction

The partial surface which is read by the sensor can have four different rotational positions, rotated through 0, 90, 180 or 270 degrees relative to the code window. In those cases where the partial surface is rotated, the reading of the code will, however, be such that the code read will be inverted and reversed in either the x-direction or the y-direction or both, in comparison to if it had been read at 0 degrees. This assumes, however, that a slightly different decoding of the value of the marks is used according to the table below.

Mark value	x-code	y-code
1	0	0
2	1	0
3	1	1
4	0	1

The above-mentioned five-bit sequence has the characteristic that it only occurs the right way round and not in inverted and reversed form in the seven-bit series. This is apparent from the fact that the bit series (0 0 0 1 0 1 0) contains only two "ones". Therefore all five-bit sequences must contain at least three zeros, which after inversion (and any reversing) result in three ones, which cannot occur. Thus if a five-bit sequence is found which does not have a position number in the bit series, it can be concluded that the partial surface should probably be rotated and the new position tested.

In order to further illustrate of the invention according to this embodiment, here follows a specific example which is based on the described embodiment of the position code.

Fig. 6 shows an example of an image with 4*4 marks which is read by a device for position determination. These 4*4 marks have the following values:

4 4 4 2

known that the commencement of the next number is one greater than the commencement of the number concerned.)

The position number is in mixed base 0*50 + 4*10 + 1*2 +0*1 = 42.

The third horizontal bit sequence in the y-code thus belongs to the 43rd code window which has a start position 0 or 1, and as there are four rows in total for each such code window, the third row is number 43*4=172.

In this example, the position of the top left corner of the partial surface with 4*4 marks is (58,170). As the vertical bit sequences in the x-code in the 4*4 group start at row 170, the whole pattern's x-columns start in the number series' positions ((2 0 4 6) -169) mod 7 = 1 6 3 5. Between the last start position (5) and the first start position the numbers 0-19 are coded in mixed base, and by adding the representations of the numbers 0-19 in mixed base the total difference between these columns is obtained. A primitive algorithm for doing this is to generate these twenty numbers and directly add their digits. Call the sum obtained s. The page or writing surface is then given by (5-s)modulo7.

An alternative method for determining which bit is the least significant in a partial surface, in order to be able to identify a code window in this way, is as follows. The least significant bit (LSB) is defined as the digit which is the lowest in a partial surface's differences or row position numbers. In this way, the reduction (redundancy) of the maximum useable number of coordinates is relatively small. For example, the first code windows in the x-direction in the example above can all have LSB=1 and the other digits between 2 and 6, which gives 25 code windows, the next can have LSB=2 and the other digits between 3 and 6, which gives 16 code windows, the next can have LSB=3 and the other digits between 4 and 6, which gives 9 code windows, the next can have LSB=4 and the other digits between 5 and 6, which gives 4 code windows, the next can have LSB=5 and

sequence of 8 bits which contains the above-mentioned bit sequence of 6 bits occurs only once and never in an inverted position or reversed and inverted. In this way, the rotational position of the partial surface can be determined by reading 8 bits in row 3, row 4, column 3 and/or column 4. When the rotational position is known, the partial surface can be rotated to the correct position before the processing is continued.

It is desirable to obtain a pattern which is as random as possible, that is where areas with excessive symmetry do not occur. It is desirable to obtain a pattern where a partial surface with 6*6 marks contains marks with all the different positions in accordance with Figs 5a to 5d. In order to increase the randomness further or avoid repetitive characteristics, a method can be used which is called "shuffle". Each bit sequence in a code window starts in a predetermined start position. However, it is possible to displace the start position in the horizontal direction for each row, if the displacement is known. This can be carried out by each least significant bit (LSB) being allocated a separate displacement vector for the adjacent rows. The displacement vector states by how much each row is displaced in the horizontal direction. Visually it can be regarded as if the y-axis in Fig. 4 is "spiky".

In the example above, with a 4*4 code window the displacement vector can be 1, 2, 4, 0 for LSB=0 and 2, 2, 3, 0 for LSB=1. This means that after subtracting the numbers 2 and 0 respectively, the above displacement is to be subtracted (modulo five) from the bit sequence's position number, before the calculation continues. In the example above, for the y-coordinate the digits 4 1 0 0 (S_2, S_1, S_0, S_4) are obtained in mixed base, where the second digit from the right is the least significant digit, LSB. As the displacement vector 1, 2, 4, 0 is to be used (LSB=0) for the digits 4 and 1, 2 is subtracted from 4 to give S_2=2 and 4 is subtracted from 1 (modulo

in a separate quadrant of a square raster pattern. In the hexagonal raster pattern the marks can be displaced in four or more different directions, for example in six directions along the raster lines and along lines which are at 60 degrees to the raster lines.

In order for the position code to be detected, it is necessary for the virtual raster to be determined. This can be carried out, in a square raster pattern, by examining the distance between the different marks. The shortest distance between two marks must originate from two adjacent marks with the values 1 and 3 in the horizontal direction or 2 and 4 in the vertical direction, so that the marks lie on the same raster line between two raster points. When such a pair of marks has been detected, the associated raster points (the nominal positions) can be determined using knowledge of the distance between the raster points and the displacement of the marks from the raster points. Once two raster points have been located, additional raster points can be determined using the measured distance to other marks and from knowledge of the distance between the raster points.

If the marks are displaced 50 μm along the raster lines, which are a distance of 300 μm apart, the least distance between two marks will be 200 μm, for example between marks with the values 1 and 3. The next smallest distance arises between, for example, marks with the values 1 and 2, and is 255 μm. There is therefore a relatively distinct difference between the least and the next smallest distance. Also the difference to any diagonals is great. However, if the displacement is larger than 50 μm, for example more than 75 μm (1/4), diagonals can cause problems and it can be difficult to determine to which nominal position a mark belongs. If the displacement is less than 50 μm, for example less than approximately 35 μm (1/8), the least distance will be 230 μm, which does not give a very large difference to

CLAIMS

1. A product comprising at least one writing area (6c) which is intended to receive handwritten information from a user and which is provided with a first position-coding pattern (5) which makes possible digital recording of the handwritten information, c h a r a c t e r i s e d in that the first position-coding pattern is a specific subset of a second position-coding pattern, which is an absolute position-coding pattern which codes coordinates for a plurality of points on an imaginary surface, the first position-coding pattern being intended both for the digital recording of the handwritten information and for authenticity checking.

2. A product according to claim 1, in which the resolution of the first position-coding pattern is such that digital reproduction of the handwritten information is made possible.

3. A product according to claim 1 or 2, in which the first position-coding pattern is constructed of a plurality of symbols (5a), each point's coordinates being coded by a plurality of symbols and each symbol contributing to the coding of more than one point.

4. A product according to any one of the preceding claims, in which the first position-coding pattern is unique to the authorised user.

5. A product according to claim 4, in which the first position-coding pattern is unique to each item of the product.

6. A product according to any one of claims 1-3, in which the first position-coding pattern is unique to one type of product.

7. A product according to any one of the preceding claims, in which the handwritten information comprises the user's signature.

certain of the regions, said information comprising the unique user identity and the server unit being arranged when carrying out the authenticity check to use the unique user identity to check the authorisation of the user.

14. A server unit according to claim 11, 12 or 13, in which a signature of the authorised user of the region is associated with at least certain of the regions, said information comprising a digital representation of a user's signature and the server unit (4) being arranged when carrying out the authenticity check to compare the signature in the received information with the signature associated with the region concerned.

15. A server unit according to any one of claims 11-14, in which the server unit is arranged to forward information to a recipient.

16. A server unit according to claim 15, in which the recipient is determined by the region affiliation.

17. A server unit according to claim 15 or 16, in which the server unit (4) is arranged to include information concerning the region affiliation in the information which is sent to the recipient.

18. A server unit according to any one of claims 11-17, in which the server unit is arranged to be incorporated in a system for electronic payment and in which said information is payment information.

19. A system for managing information, which system comprises a server unit (4) and a plurality of user units (2), each of which is arranged to record and send information to the server unit (4), c h a r a c t e r i s e d in that

information is stored in the server unit (4) concerning a plurality of regions, each of which represents a coordinate area on at least one imaginary surface,

each of the user units is arranged to record the information in the form of at least two coordinates for at least one point on the imaginary surface, and

region and in which the server unit (4) is arranged to check the authorisation of the user by means of the region affiliation and in which the server unit is arranged to include information concerning the user's authorisation in the information which is sent to the recipient.

27. A system according to any one of claims 19-26, in which said plurality of user units are arranged to record a signature electronically for a user, the recording being carried out in the form of coordinates which are read from a product on which the user writes his signature and the information which is sent to the server unit comprising at least certain of the read-off coordinates.

28. A system according to claim 27, in which the server unit (4) is arranged to compare the signature received from the user unit with a previously-stored signature of the authorised user and to include information concerning the authenticity of the signature in the information which is sent to the recipient.

29. A system according to any one of claims 19-28, in which the system is a system for electronic payment and in which the information which is received from the user unit is payment information.

30. A system according to claim 29, in which the server unit (4) is arranged to verify the payment information by checking that the user identity belongs to the authorised user of the product and to include information concerning this in the payment information.

31. Use of an absolute position-coding pattern on a product in order to make possible checking of a user's authorisation to use the product, in which the absolute position-coding pattern is unique to the authorised user.

32. Use according to claim 31, in which the absolute position-coding pattern is used to record the user's signature electronically.

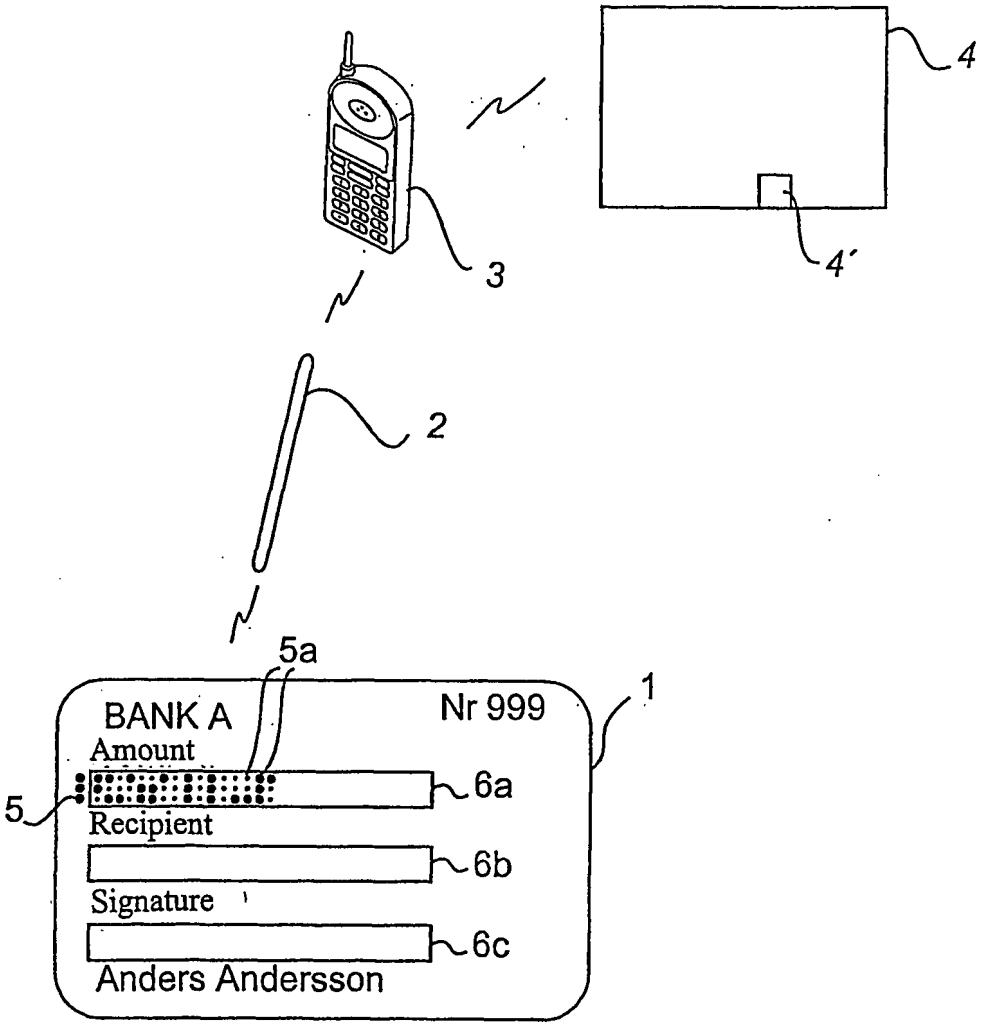


Fig. 1

30 Region	31 Owner	32 Recipient	33 User	34 Signature	35 User identity
$(X_1Y_1); (X_2Y_2)$ $(X_3Y_3); (X_4Y_4)$	The bank A	Bank@sek.s	Anders Andersson	*Anders Andersson*	123 456 789

Fig. 3

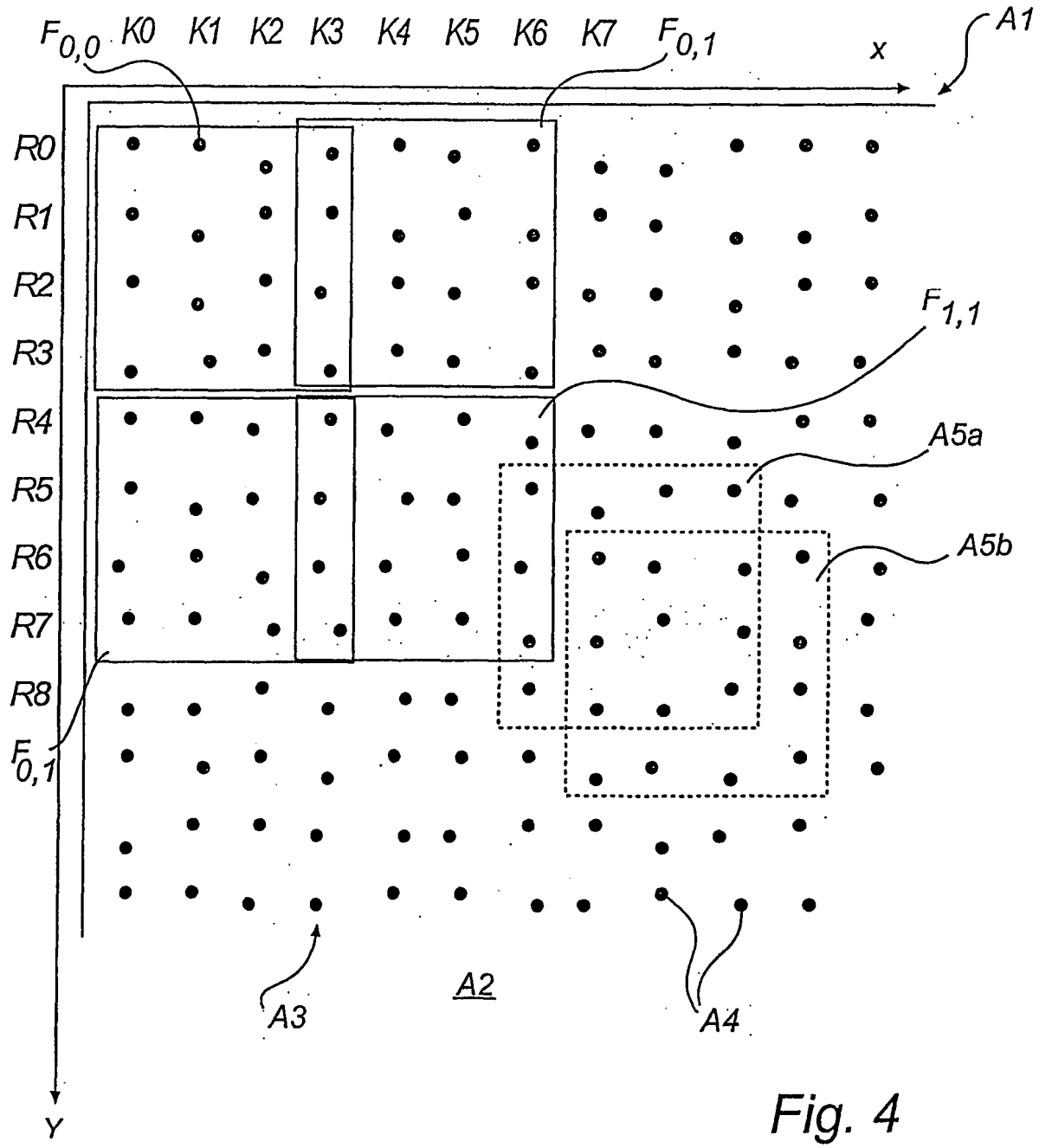

F0,0
K0
K1
K2
K3
K4
K5
K6
K7
F0,1
x
A1
R0
R1
R2
R3
R4
R5
R6
R7
R8
F1,1
A5a
A5b
F0,1
A2
A3
A4
Y

Fig. 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 00/02660

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: G06F 17/60, G06F 3/033, G06K 11/18
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: G06F, G06K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0132241 A2 (ESSELTE SECURITY SYSTEMS AB), 23 January 1985 (23.01.85), page 7, line 11 - line 17; page 8, line 12 - line 34; page 10, line 6 - line 28, claims 1,8,11,12, abstract --	1-35
A	US 5852434 A (O.SEKENDUR), 22 December 1998 (22.12.98), column 2, line 48 - line 58; column 3, line 7 - line 41, figures 1-5, claims 1,5,19, abstract --	1-35
A	US 5027414 A (C.HILTON), 25 June 1991 (25.06.91), claims 1,3,5,9,12 --	1-35

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
27 March 2001	02 -04- 2001
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Pär Heimdal/LR Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

Information on patent family members

25/02/01

International application No.
PCT/SE 00/02660

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0132241 A2	23/01/85	AT 70649 T	15/01/92
		DE 3485359 A	30/01/92
		SE 463896 B,C	04/02/91
		SE 8303799 A	02/01/85
		US 4581482 A	08/04/86
US 5852434 A	22/12/98	AU 4529896 A	14/07/97
		US 5477012 A	19/12/95
		WO 9722959 A	26/06/97
US 5027414 A	25/06/91	DE 3880847 A,T	17/06/93
		EP 0276109 A,B	27/07/88
		GB 2200233 A,B	27/07/88
		GB 8701206 D	00/00/00
		GB 8709502 D	00/00/00
		GB 8719625 D	00/00/00
		GB 8801003 D	00/00/00
		JP 63192169 A	09/08/88
GB 2306669 A	07/05/97	DE 19644109 A	07/05/97
		GB 9622632 D	00/00/00
		JP 9128137 A	16/05/97
		US 6081261 A	27/06/00